



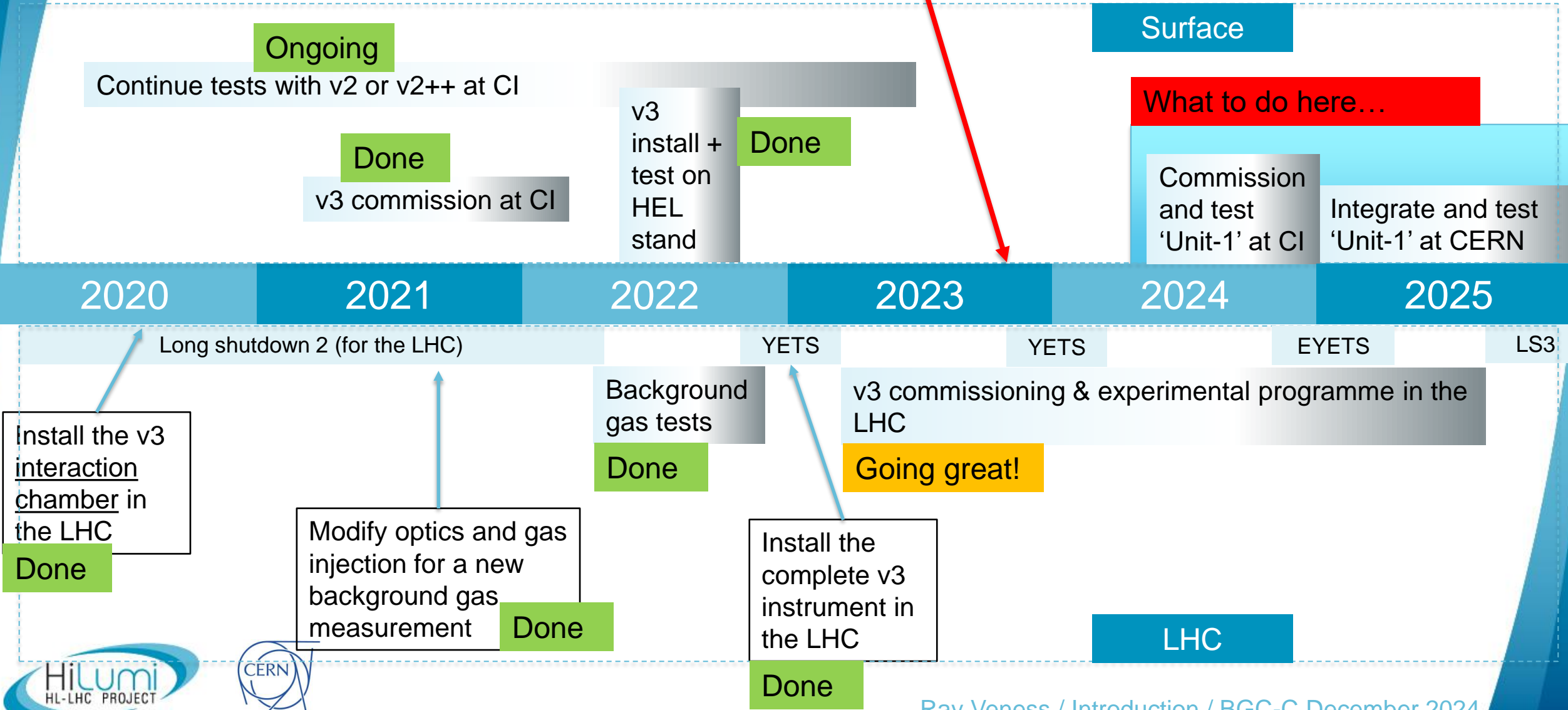
# Looking forward to the BGC Collaboration Meeting

Ray VENESS



***Liverpool 2-3 December 2024***

# Project roadmap (December 2023 meeting)



# Actions from the December 2023 meeting

- Define a new set of specification parameters for v4 LHC simulations **DONE**
- Re-optimize the optical system for v4 **DONE**
- Aim for an operational fixed display in the CCC for the ion run **DONE**
- Decide on next-step instrument: v3+ or v4? **DONE?**
- Decide on location for a second LHC instrument (IR4 or IR6) **DONE?**
- Manufacture the v4 instrument for the EBTS **IN PROGRESS**
- Analyse ion x-section from 2023 data through-cycle **IN PROGRESS**
- Improve understanding of errors through the system for a potential x-section measurement in the LHC **IN PROGRESS**
- Justify the case and safety of N2 injection **IN PROGRESS**
- Order and install a new image intensifier for LHC June TS **STATUS?**
- Increase the travel of the alignment system on the optics **STATUS?**
- Request a BatMon campaign to improve potential shielding gains **STATUS?**
- Decide on our LHC instrument optimization – resolution or integration time **STILL TO DO**
- Decide when to make the change to N2 in the LHC **STILL TO DO**

# Options for HL-UK2 deliverables: Protons and ions

- Current HL-UK1 (v3) design was built as an **overlap monitor for the HEL** and was installed in the LHC in YETS22-3 with operations since then
  - This implied several significant design constraints, limiting performance
    - **Very limited space** (200 mm) between HEL solenoids available along the beam axis
    - **Wide gas jet** required to cover the large e-beam as well as the p+ beam
    - Strong magnetic field of HEL solenoid **limits the choice of gas species**
- The design can be optimized if we choose to use as a stand-alone **profile measurement device for HL-LHC**
  - **Alternative gas jet species** (currently Ne)
    - N<sub>2</sub> has a higher fluorescence cross-section and would give more signal (~5x)
  - Smaller **gas jet width** (just wide enough to reliably observe the p+ beam without an e- beam)
    - Less gas load on LHC and lower beam-gas background
  - **Thinner** gas sheet
    - Improved vertical profiles (see D.Butti talk) and less gas load on LHC
    - Comes at the cost of a reduced signal intensity, so longer integration times
  - Space for **additional vacuum pumps** on the beam axis
    - Lower beam-gas background and less gas load on LHC
    - Alternative pumping technologies (NEG, cryo-pumping)
    - More space for integration on the Beam 2 line



# Proposed next steps in the LHC upto LS3

## Run 3 / 2024

- Continue operation as profile monitor for protons and ions
- Stress-test as an 'operational instrument' for ions in the upcoming ion run

## YETS24-5

- Installation of **new 3<sup>rd</sup> skimmer**, optimized for LHC protons and ions
- Installation of **two new BLMs** to allow evaluation of halo signal acquisition
- Install new **nitrogen bottle** to allow gas switch during a Technical Stop
- Automation of gas injection process with TE-VSC and review the operational scenarios

## Run 3 / 2025

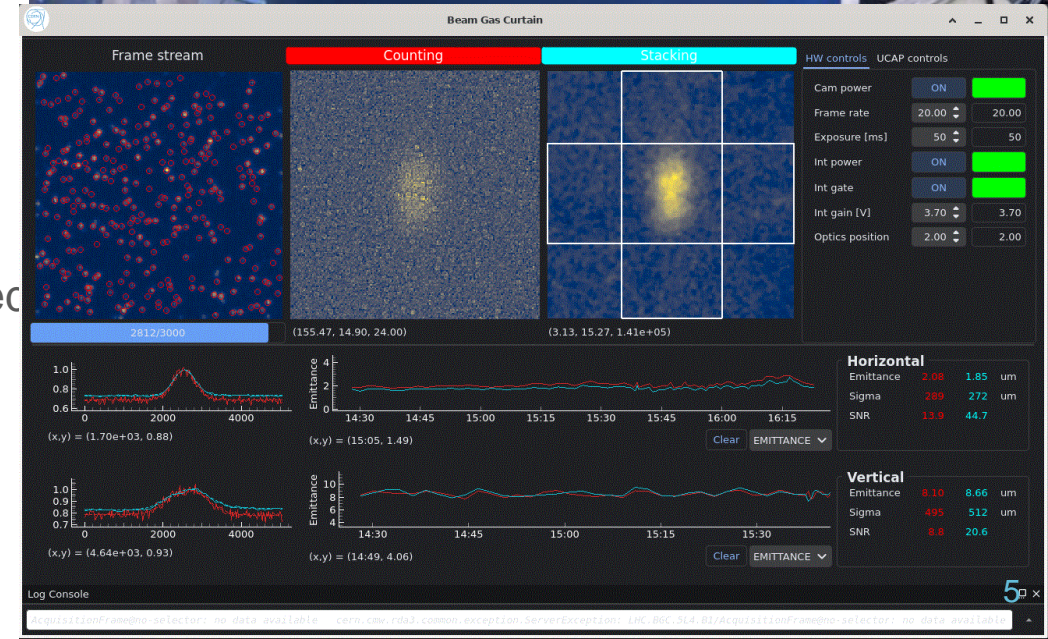
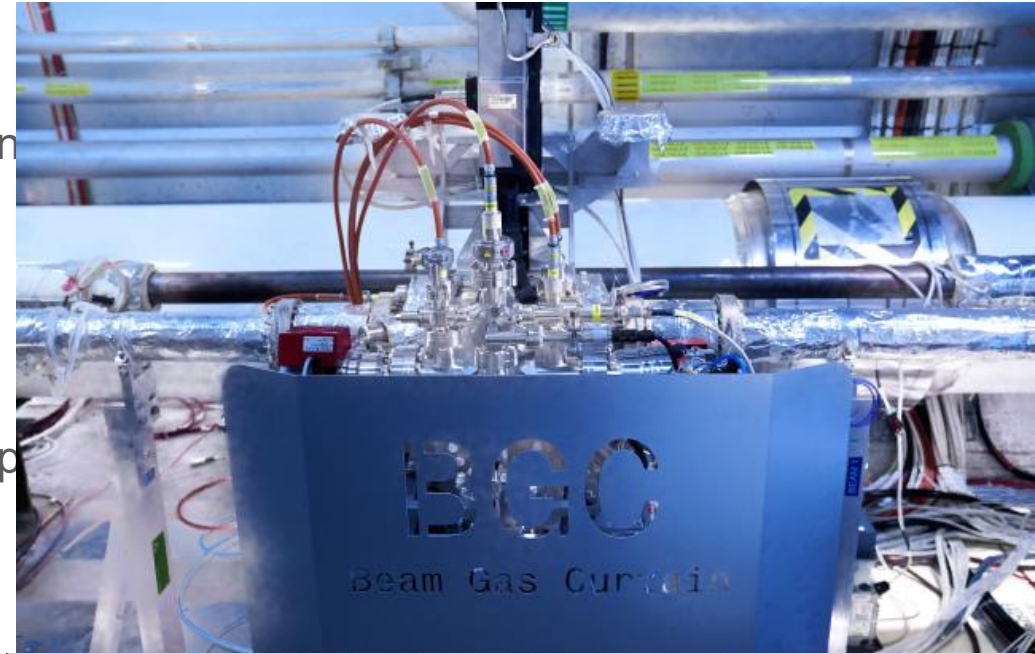
- Continue operation as **profile monitor** for protons and ions
- Collect BLM data to understand background for **possible halo monitoring**
- Potentially **switch to N<sub>2</sub>** during the year

## YETS25-6

- Potentially change skimmer configuration to a halo monitor optimised design, plus other improvements
- Sufficient access time during YETS25-6 is important!**

## Run 3 / 2026

- Potential validation of BGC as a halo monitor



# Plans for the BGC in LS3

Install the 2<sup>nd</sup> in-kind deliverable instrument in the LHC

Complete the integration on the Beam 2 (QRL-side) line for LSS4

Addition of cabling and vacuum equipment

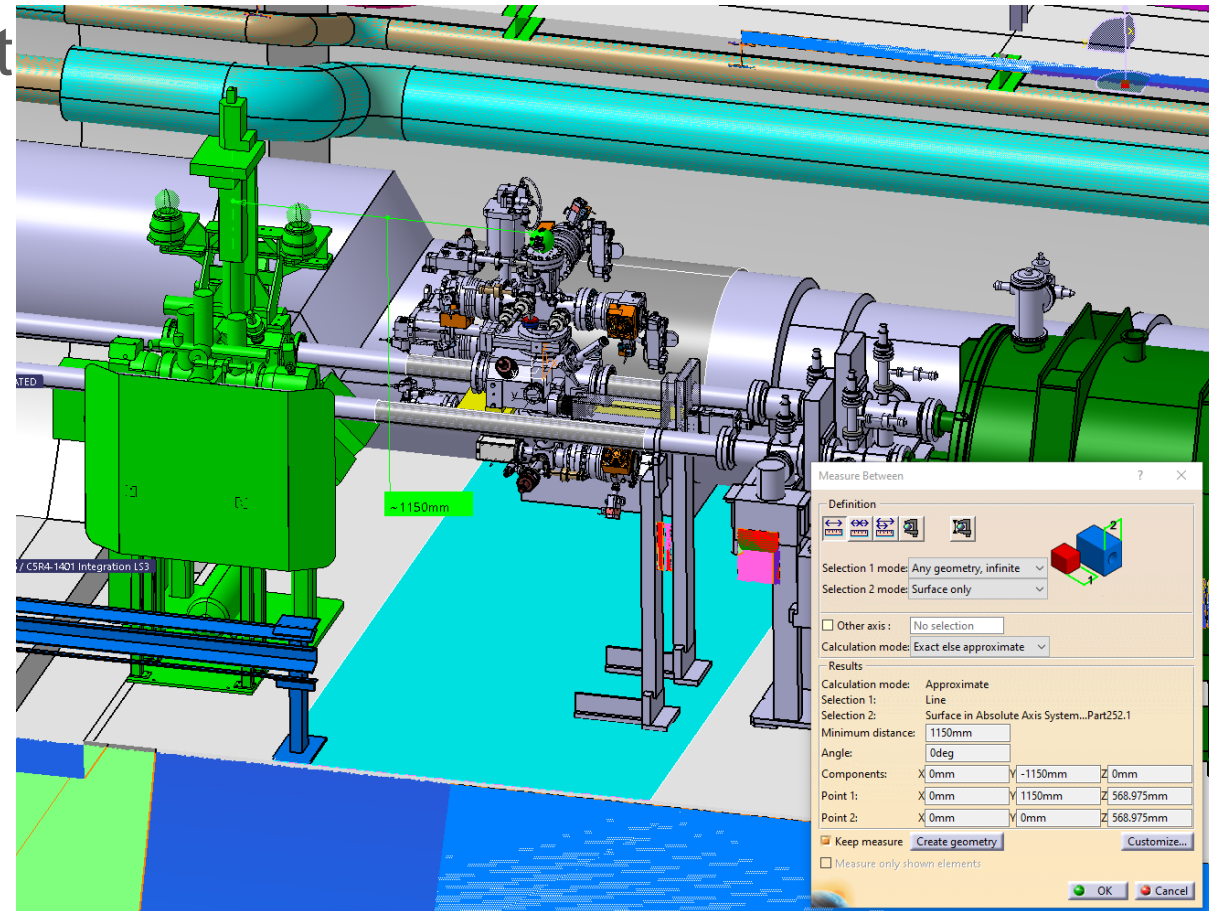
Reconfigure skimmers and pumping in the existing beam 1 device

Options exist for proton, ion and/or halo monitoring options on both beamlines

New simulation tools for gas jet design

Developed by O. Stringer (HL-UK2 Liverpool PhD)

Greatly simplifies the design process for gas jet optimisation



Preliminary integration study for LHC beam 2

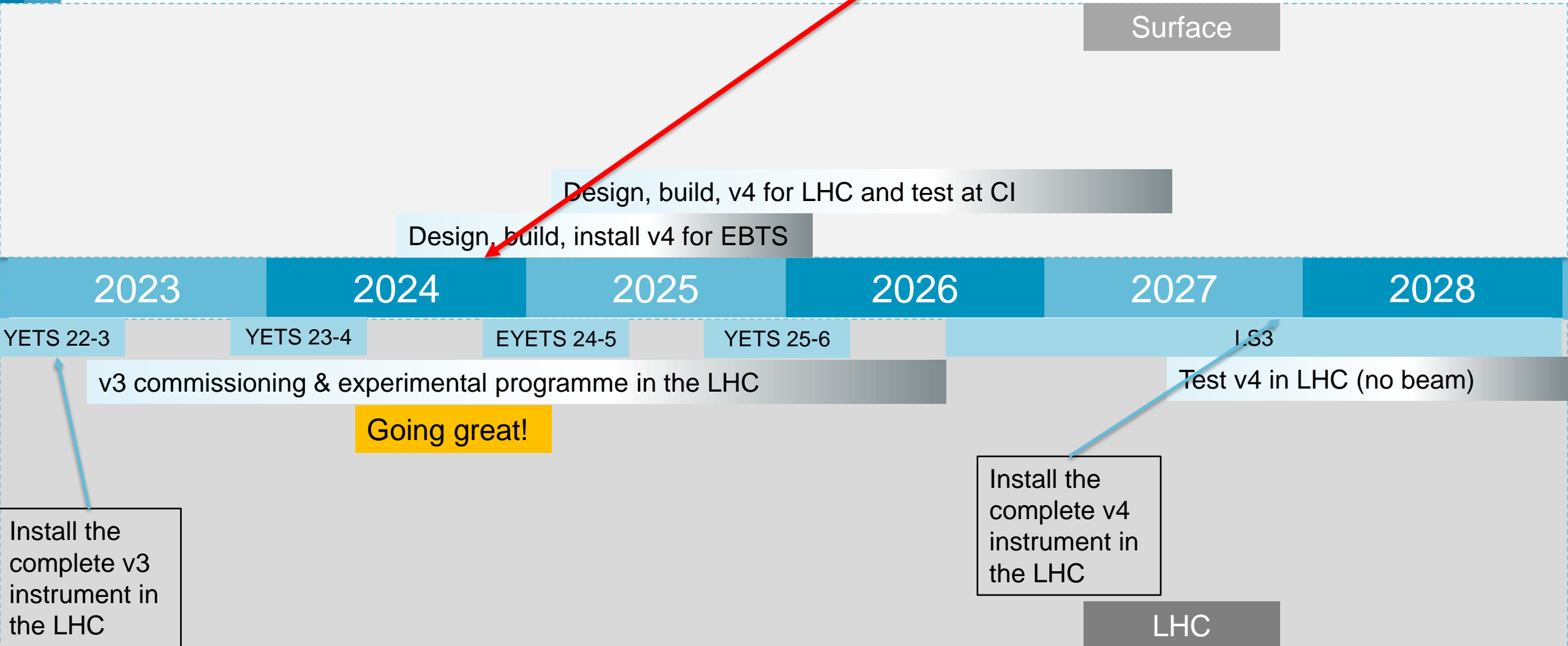
Slide from HL annual meeting 10/24



- ❑ O.Stringer et al. First measurement of the proton beam and lead ion beam in the LHC using beam gas curtain monitor [IPAC 2024]



# Project roadmap (December 2024 meeting)



# Questions for this meeting

- Scientific specification:
  - What instrument do we want for the LHC? Precision instrument, on-line monitor, halo monitor or 'all'?
    - If we can't decide this today, what is the decision path?
  - What is the best gas? N<sub>2</sub> or Ne? Does this depend on the above question?
- Technical specification
  - What are we able to build for the LHC with the space, time and resources available?
  - Do we need to compromise on the scientific spec (e.g., 45°, location...)
- Funding
  - We need to identify all the cost components (not necessarily the actual number) needed to have our preferred v4 designs on both LHC beamlines
    - Consider equipment, services, design and integration manpower
  - We need to assign these to our different possible resource sources
    - HL-UK(2-3), BI LS3 budgets, HL-WP13 envelope for profile and halo measurements



# Let's get started with the rodeo!!

